

*Remembrancer*, and also in the third edition of Kitto's *Biblical Cyclopædia*, viz. "Divination," "Ham," "Jesus Christ," "Laws of Moses," and about fifty others, 1860-66; "On the Irish Church Question," 1868; "On the Connection between Church and State," a paper read at a Synod of the Plymouth Deanery; also Tertullian's "Five Books against Marcion," translated for Clark's *Ante-Nicene Christian Library*, Edinburgh, 1866; also Tertullian's "Ad Nationes," in the same series, 1869; Tertullian's "De Præscriptione Hæreticorum," "Adversus Hermogenem," "Adversus Valentinianos," "De Carne Christi," "Adversus Praxean," and other tracts by the same Father, translated for the same series, 1870; "The Anti-Pelagian Works of St. Augustine"; "De Peccatorum Meritis et Remissione"; for Clark's English Edition of St. Augustine's Works, 1871; and fourteen other treatises in 8vo. volumes.

Dr. Holmes was domestic chaplain to the Countess of Rothes. He leaves a widow, but no children.

HENRY JOHNSON resided at 39 Crutched Friars, London, E.C., where he carried on the business of a wine merchant. He was much attached to mechanical pursuits, and erected a workshop at the top of his house, where he constantly employed one or two skilled workmen. He was the inventor of the *Volutor*, an apparatus for describing spirals, which is described in the *British Association Report* for 1869 (Transactions of the Sections, p. 60), and of a deep sea pressure gauge (see *British Association Reports*, Transactions of the Sections, 1859, p. 236, and 1860, p. 202). The object of the latter was to determine the pressure of the water at great depths in the sea by means of the compression of the water contained in the instrument, which may be regarded as a small hydraulic press, of which the ram is forced into the cylinder by the increasing pressure of the sea when sinking, and expelled by the expansion of the water in the cylinder when rising. Both instruments were exhibited in the Exhibition of 1862, and are described in the official report of the Jurors, Class XIII., pp. 16 and 41. Mr. Johnson also exhibited a metallic deep sea thermometer, to be used in experiments with his deep sea pressure gauge, so contrived that the indications of the instrument were not at all liable to be disturbed by the great pressure of the water upon it (*Ibid.* p. 38). He made numerous experiments with the deep sea pressure gauge in comparatively deep water off the Isle of Wight. For six or seven years before his death he had become completely broken down in health, and had resided chiefly at Worthing. Mr. Johnson never married.

The Rev. ROBERT MAIN, M.A., F.R.S., was born at Upnor, in Kent, on the 12th of July 1808, and was educated at a

private school of deservedly good repute at that time, which was conducted by a sound mathematician (the Rev. J. Neave), whose memory he always held in great esteem, and to whom he considered himself indebted throughout his after career for the good education he received from him, more especially for the knowledge of Euclid and Algebra beyond what was usually taught in those days. After leaving school he became engaged in tuition as a master in the Grammar School at Bishop's Waltham, Hants (of which the Rev. T. Scard was the head master), where he remained until he left it for Cambridge. In 1831 he entered Queens' College in that University, and after a successful course of study graduated as Sixth Wrangler in 1834. He was shortly afterwards elected to a Fellowship, but did not reside at Cambridge very long, for, on the appointment of Professor (now Sir George) Airy in the year 1835 to succeed Mr. Pond as Astronomer Royal, he was offered and accepted the office of First (or, as it is now called, Chief) Assistant at the Royal Observatory, which necessitated his removal to Greenwich. The published volumes of the Royal Observatory from 1836 to 1860 supply sufficient evidence of the energetic way in which Mr. Main supported the Astronomer Royal in the measures he took to carry on the scientific operations of that establishment. Everyone who has had much to do with large observatories well knows the great value of such support, and it is to Mr. Main's careful superintendence of the observations and subsequent calculations for very nearly a quarter of a century that a considerable part of their accuracy and completeness is due.

But although his application to these duties occupied for so long an interval the principal part of Mr. Main's time, the publications of the Royal Astronomical Society witness that his scientific energy was by no means thus exhausted. He availed himself of every opportunity of utilising the results obtained at Greenwich for the benefit of practical and theoretical astronomy, and we shall notice briefly a few of the applications to which they were, in his hands, thus applied. The first of these, we believe, consists of a series of papers on the correction of the Elements of the Orbit of *Venus*, published in 1837 and 1838, and in which the observations of that planet by Professor Airy, at Cambridge, during the years 1833-35 are made use of for comparison with the *Nautical Almanac* places then derived from Lindenau's Tables, as well as later observations obtained at the Royal Observatory. In 1840 Mr. Main contributed a paper to the Society, "On the present state of our knowledge of the Parallax of the Fixed Stars." Such knowledge was then but small, and till recently much more of a negative than a positive kind; but it is always of great importance that attention should be called to the existing state of a subject in which there is reason to suppose that considerable advances are shortly to be expected, and we need hardly remark that this was then

the case with the problem, so long supposed to be insoluble, of the parallax and distance of the fixed stars. In February 1841 Mr. Main was elected one of the Honorary Secretaries of the Society, and for some years the duties of that office were ably discharged by him, in conjunction, first with Mr. Rothman, and afterwards with Mr. Galloway. On his retirement therefrom in 1846, the Council acknowledged his services in the following words:—"In addition to the zeal in behalf of the Society which has actuated him, in common with others, Mr. Main has brought to the duties of his office a close acquaintance with practical astronomy as well as theoretical, and the habits of order demanded by a daily attention to astronomical duties more onerous than those of our Secretaryship. So heavy, indeed, are these last that the Council acknowledge peculiar obligations to the gentleman who, residing at so great a distance, and pressed by public calls of such magnitude, has for years found time to be the constant superintendent of the routine of our business and a regular attendant at our meetings." In reference to the paper before mentioned on the parallax of the fixed stars, we may quote the words of Sir John Herschel in his speech on giving the Gold Medal of the Society to Professor Bessel in 1841, for his noteworthy success in first obtaining, in the case of 61 *Cygni*, a parallax generally acknowledged to be trustworthy and claiming the acceptance of astronomers. "In whatever reference," he says, "I may have to make to the history of the subject, I must take this opportunity to acknowledge my obligations to the author of this paper, as well as for his exceedingly luminous exposition of the results of those more successful attempts on the problem by Henderson, Struve, and Bessel, which I shall now proceed more especially to consider." And further on—"This is the final and severe test: Mr. Main has applied it, and the results have been placed before you—*oculis subjecta fidelibus*. If all this does not carry conviction along with it, it seems difficult to say what ought to do so."

On resigning the secretaryship, Mr. Main was elected one of the Vice-Presidents of the Society. In 1849 he contributed to the Society a paper on the form of the planet *Saturn*, suggested by Sir William Herschel's conjecture, from repeated estimations, that its figure was not elliptical but "like a parallelogram with the corners rounded off." Mr. Main gives a series of careful measurements with a micrometer in 1848 and 1849, the result, which was confirmed in subsequent papers, appearing to establish the perfect ellipticity of the planet's shape. In 1850 appeared his first paper on the important subject of the proper motion of the fixed stars. The final result of the discussion and determination of the proper motion of all stars contained both in Bessel's *Fundamenta* (formed from Bradley's Greenwich observations) and in Airy's Twelve-Year and Six-Year Star Catalogues are too well known to astronomers to need any detailed description here. The next paper of importance communicated by Mr. Main was published in 1855, and contains an investigation of the

values of the constants of nutation and aberration, and of the parallax of  $\gamma$  *Draconis*, as deduced from the observations made with the twenty-five foot zenith tube at the Royal Observatory, Greenwich. The observations discussed extend from June 1837 to May 1848, and were tolerably continuous throughout that time, the only exceptions being from periods of bad weather and the difficulties of seeing the image of the star well in the daytime, which required a more than usually transparent state of the atmosphere. The instrument, which was superseded, at the end of these observations, by the present reflex zenith tube, was erected by Troughton whilst Mr. Pond was Astronomer Royal; but no regular use, in a way suitable for delicate inquiry, was made of it in Mr. Pond's time. Mr. Main considered that the value deduced of the nutation constant was entitled to considerable weight; that of the annual parallax is negative and therefore inadmissible, though sufficient to prove that the true value, was exceedingly small. Mr. Main next published a valuable paper on the apparent diameters of the large planets, from measurements made with Airy's double-image micrometer attached to the East Equatoreal of the Greenwich Observatory. The observations, a large proportion of which had been made by Mr. Main himself, extend over a space of more than twenty years, commencing with the Astronomer Royal's invention of the instrument and its construction in the year 1840. We have already referred to previous papers on the observations made by the author for determining the form and ellipticity of *Saturn*; the present one (published in 1856) is chiefly concerned with the diameters of *Mercury*, *Venus*, *Mars*, and *Jupiter*. In the earlier communications, measurements are included, not merely of the body of *Saturn*, but of the rings and whole system of that planet.

In 1857 Mr. Main turned his attention to the important subject of the value of the constant of refraction, his investigation being derived from zenith distance observations of stars near the north and south horizon made at the Royal Observatory in the years from 1836 to 1854; the result being to modify to some extent the values of the refraction previously used for stars observed at great distances from the zenith. We need hardly remark that this is an element of uncertainty which has always given practical astronomers a great deal of trouble and anxiety.

The time had now arrived when it was felt that some public recognition ought to be made of the value of Mr. Main's various and important labours. Accordingly, in February 1858, the Gold Medal of the Society was awarded to him "for his various contributions to the *Memoirs* of the Society," the duty of presenting it and making the usual address on the occasion being discharged by the President, the late Mr. Johnson, who then was filling the office of Radcliffe Observer at Oxford, in which Mr. Main was himself so soon to succeed him.

In the following year, 1859, Mr. Main was deputed, in con-



sequence of the continued illness of the President, the late Mr. Bishop, to pronounce the annual address on the award of the Gold Medal to Mr. Carrington for his Redhill Catalogue of Circumpolar Stars; and this duty was discharged with much ability. At the same meeting Mr. Main was elected President of the Society, and filled this office for the customary term of two years, during which it fell to his lot to deliver presidential addresses on the presentation of the medal to the great physical astronomer, Professor Hansen, of Gotha, for his Lunar Tables; and to M. Hermann Goldschmidt, of Paris, for his discovery of thirteen small planets and other works in observing astronomy, many of which had been performed with seemingly very inadequate means.

Reference should not be omitted to an interesting paper by Mr. Main, communicated to our *Monthly Notices* for June 1859, "On the Present State of the Controversy respecting the Amount of the Acceleration of the Moon's Mean Motion." It is well known that Dr. Halley appears to have been the first to notice the fact of there being such acceleration, though the state of the lunar theory in his day was not sufficiently advanced to enable him to give even a probable guess as to its magnitude. Laplace partly explained its cause, but subsequent observations showed its amount to be much greater than had been supposed, and Professor Adams came to the conclusion that existing theories were only capable of accounting for a part of the effect actually observed. M. Delaunay also investigated the subject, and obtained a result essentially agreeing with that of Professor Adams, which was, however, disputed by Professor Hansen and other mathematicians. Mr. Main gives, in the paper before us, a careful *résumé* of the discussion, concluding it with the expression of his opinion that, "as far as we can judge from what is before us of the theoretical investigations of all concerned, Adams and Delaunay seem to have right on their side." This view was afterwards generally accepted by astronomers, so that an outstanding discrepancy between theory and observation remained to be explained. A possible cause has been suggested in a retardation of the diurnal motion of the Earth on its axis produced by the friction of the tidal wave, so that the discrepancy would consist, not in a greater acceleration of the Moon's mean motion than that accounted for by theory, but in an alteration of our unit of time in estimating it.

Allusion has already been made to Mr. Main's determination of the value of the constants of aberration and nutation from the observations with the old zenith tube of the Royal Observatory. The result for the former element was too discordant with other values to be considered very satisfactory, and in 1860 Mr. Main made another determination from eight years' observations with the new reflex tube, the simplicity of the construction of which almost removed all causes of dread of error arising from mechanical or instrumental causes. The value of the constant

of aberration thus found was 20''·34, which is entitled to considerable confidence. Mr. Main also made a fresh determination from these observations of the annual parallax of  $\gamma$  *Draconis*. As before, the result was a small negative quantity, proving only that the true value was exceedingly small.

Mr. Main retired from the chair of the Society in February 1861. But before that occurred, an important event in his life had taken place to which reference has already been made. On the 1st of March 1860, Mr. Manuel J. Johnson died, after having devoted nearly twenty years to directing the work of the Radcliffe Observatory. The trustees, in the month of June 1860, nominated Mr. Main to succeed him, and thus terminated his long connection with the Royal Observatory. The Astronomer Royal, in his Report to the Board of Visitors on the 1st of June 1861, expresses himself thus:—"Mr. Main, who had for twenty-five years held the office of First Assistant, and to whose zeal and orderly assiduity and honourable conduct on every occasion the position of the Observatory is in no small degree due, accepted in the last summer the office of Radcliffe Observer at Oxford, and on September 30 resigned his occupation at the Royal Observatory."

The last paper Mr. Main contributed to the Society before his removal to Oxford was one read at the meeting on April 13, 1860, entitled "Remarks on the Controversy respecting the Secular Acceleration of the Moon's Mean Motion." This paper is supplementary to the one on the same subject we have already referred to; deprecating any definite general conclusion on the whole matter before the publication of the theories of Hansen and Delaunay, but contending that there was very great reason to accept the conclusion of Adams and Delaunay, and to believe that "they have given the correct value of the acceleration depending on the diminution of the eccentricity of the Earth's orbit." It was called forth by a paper of Dr. Hartwig, of Schwerin, who had misunderstood Mr. Main's views on the point in consequence of his non-reference to it in the speech on the presentation of the medal to Professor Hansen.

At the meeting on January 11, 1861, he gave from the chair a short account of the proceedings at the Radcliffe Observatory since the decease of Mr. Johnson and his own appointment as Radcliffe Observer, and in the following May he communicated some observations of his own of phenomena of *Jupiter's* satellites made with the telescope of the heliometer at that Observatory. This instrument was constructed by Messrs. Repsold, of Hamburg, and formed a valuable addition to the instrumental equipment of the Radcliffe Observatory. From unavoidable delay in its completion, it was not received at the Observatory until the winter of 1848; a detached building was erected for it the following summer, and in October the instrument was set up under the personal superintendence of Adolph Repsold. The object-glass (made by Merz, of Munich)

has an aperture of  $7\frac{1}{2}$  inches and a focal length of 10 feet 6 inches. A great improvement in the meridional observing took place under Mr. Main's directorship through the purchase of the Transit Circle which had been used by Mr. Carrington at Redhill. The diameter of the object-glass of this instrument is 5 inches and its focal length 66 inches. It was removed to Oxford in the summer of 1861, and observations with it commenced in 1862. Mr. Main was soon able to endorse Mr. Carrington's statement as to its excellence; and the meridional instruments previously in use were now superseded for Observatory purposes, being retained, however, in the building for practice, if required, by students of the University.

From the time we have mentioned, almost to that of his decease, Mr. Main continued most assiduously to apply himself to keeping up and extending the reputation of the Radcliffe Observatory; the zeal and diligence with which he did so being sufficiently evidenced in the successive volumes of observations which have punctually and regularly made their appearance year by year.

Not long before Mr. Main's appointment, Mr. Johnson had completed the scheme of star-observation on which he had for some years so usefully employed that part of the resources of the Observatory—the reobservation of the stars of Groombridge's Catalogue, from which much valuable information respecting stellar proper motion &c. has been derived. On its completion he had prepared a list of remarkable stars which he thought it desirable to have carefully reobserved, consisting chiefly of stars of greater magnitude than the third, stars within  $6^\circ$  of the North Pole, and stars possessing physical peculiarities, or having orbital proper motion. This list Mr. Main made it his first care to complete, and he accomplished it by the end of 1861, although the Catalogue containing the observations (reduced to the epoch 1860) could not, owing to the pressure of other work, be published till 1870. The Catalogue in question contains no less than 2,386 stars, and forms the "Second Radcliffe Catalogue," the observations on which it is founded being made from the years 1854 to 1861 inclusive. With 1862, as we have mentioned, commenced the observations with the Carrington Transit Circle; and the first five years of its use were given, as far as star-observing was concerned, to the observations of a large number of stars between the fifth and seventh magnitudes. In 1867 a new working list of stars was prepared, including all the stars in the British Association Catalogue which still required to be observed, together with others between the sixth and eighth magnitudes found in various Catalogues, chiefly included in celestial zones from  $50^\circ$  to  $70^\circ$  N.P.D. Mr. Main intended to form a Third Radcliffe Catalogue from observations of nearly 4,400 stars made during the nine years ending in 1870; this laborious work was commenced in 1876, but he did not live to complete it.

With regard to planetary meridional observations, Mr. Main

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thought it useful to observe continuously the Sun, and the Moon when she passed the meridian before or very soon after midnight, it being too great a tax on the strength of the Observatory to carry the latter on beyond this. During his first years at Oxford he kept up at certain times meridian observations of all the large and some of the small planets; but afterwards he retained only amongst the former the inferior planets, especially *Mercury*, which the shortness of its period and the frequent difficulty of seeing made it more desirable to observe whenever practicable, and of which many valuable observations were made on days when it was not seen elsewhere.

For details of the cometary and phenomenal observations of various kinds out of the meridian we must refer to the printed volumes of *Observations*. The heliometer was employed in measurements of distances of double stars (especially Struve's *Lucidæ*), of planetary diameters, &c.; by far the greatest part of these were made by Mr. Main himself. A series of observations with it, accompanied by delineations, of spots seen on the Sun commenced to be made in the month of November 1874; these, which were chiefly made by one of his assistants, are printed and engraved in the volume for 1875, the last which Mr. Main published, the date of its Introduction being December 14, 1877. His death occurred on May 9, 1878.

Enough has been said to show that the *Radcliffe Observations* have contributed to the general progress of astronomy. The reductions were carefully and rigorously kept up, and in their methods sundry improvements, particularly in the calculation of the occultations, were introduced. Meteorological observations were also regularly carried on; but his multifarious observatory duties by no means exhausted Mr. Main's energies or scientific activity. He published in 1863 a book entitled "Practical and Spherical Astronomy for the use chiefly of Students in the Universities." This work is referred to in the Annual Report of the Council for 1864 as follows: "It is nothing more than an act of simple justice to the merits of Mr. Main's volume to say that it is the first successful attempt in this country to furnish the student not only with the mathematical deductions of astronomical formulæ, but at the same time with the best methods of their practical application in the actual business of an Observatory." Previously to the appearance of this important work, Mr. Main had published a translation of the first part of Brünnow's *Lehrbuch der Sphärischen Astronomie*, which includes the chapters on Parallax, Refraction, Precession, and Nutation, and which, from its acknowledged excellence, he considered might be of service at Cambridge and other Universities in which the mathematical sciences are cultivated.

Mr. Main was elected a Fellow of the Royal Society in 1860, and served for several years on its Council. His last communication to our Society was, we believe, a paper containing observations of the remarkable meteoric shower in November 1866.



Mr. Main's studies were not at all confined to astronomy. He was a most diligent student during his boyhood and during the whole of his life, and consequently his attainments were very varied. In a biography already published in a church periodical called the *National Church*, we are told that his *Modern Philosophic Scepticism Examined*—an elaborate address delivered at the request of the Victoria Institute, at their ninth annual meeting—passed through many editions. Mr. Main was selected to preach before the British Association at Bristol in 1875; and, on leaving Greenwich, he published a volume of sermons (which he had preached while residing there).

His acquaintance with Latin and Greek was sufficient to enable him to derive a pleasure from reading in those ancient languages which throughout his life he frequently indulged. Of modern languages his knowledge was more extensive than that of most scholars of his time. He could read and translate fluently French, Italian, German, Dutch, Spanish, Portuguese, Danish, and Swedish; and this was of immense service to him by enabling him to read the works of foreign astronomers. In 1838 he married the sister of the Rev. Professor Kelland, who was Senior Wrangler in 1834, and has left three sons—Robert, of the Admiralty; Philip, Fellow of St. John's College, Cambridge, who was Sixth Wrangler in 1862; and Francis, M.A., of the Inner Temple. His only surviving brother is the Rev. Thomas J. Main, who was Senior Wrangler in 1838, and for many years head of the Royal Naval College, Portsmouth.

JOHN MATHESON was born in Glasgow on the 6th of October 1817. Having completed his education, he proceeded to qualify himself for a commercial life, serving for this purpose with the firm of John Matheson & Co., of which his father was the principal partner. Subsequently he obtained an appointment in the house of William Stirling & Sons, turkey-red dyers, one of the most extensive establishments in the country engaged in that important branch of industry. In this new sphere of exertion he soon exhibited great ability and energy, united with rare business talents, and the result was that, after the lapse of a few years, he attained the position of managing partner, and ultimately became the sole proprietor of the establishment. In 1859 he married Miss Jessie Merry Forrester, daughter of the late Robert Forrester, Esq., of Glasgow.

The career of Mr. Matheson outside the calls of business was distinguished by untiring activity. Although he studiously abstained from taking part in the municipal affairs of his native city, he exhibited a deep interest in public questions, and in every movement having for its object the advancement of the material or social condition of the community amidst which he lived. He spoke and wrote with uncommon clearness and vigour, and the results of a sound discriminating judgment were

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